

The documentation and process conversion measures necessary to comply with this revision shall be completed by 3 January 2003.

INCH-POUND

MIL-PRF-19500/286F
3 October 2002
SUPERSEDING
MIL-S-19500/286E
27 July 1994

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER
TYPES 1N4245 THROUGH 1N4249, 1N4245EG1 THROUGH 1N4249EG1, JAN, JANTX, JANTXV, and JANHC

This specification is approved for use by all Departments and Agencies of the Department of Defense.

These devices are inactive for new design, preferred devices are - 1N5614, 1N5616, 1N5618, 1N5620, 1N5622 on MIL-PRF-19500/427.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for silicon, power rectifier, medium-recovery diodes. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1, figure 2, and figure 3 epoxy-glass case outline.

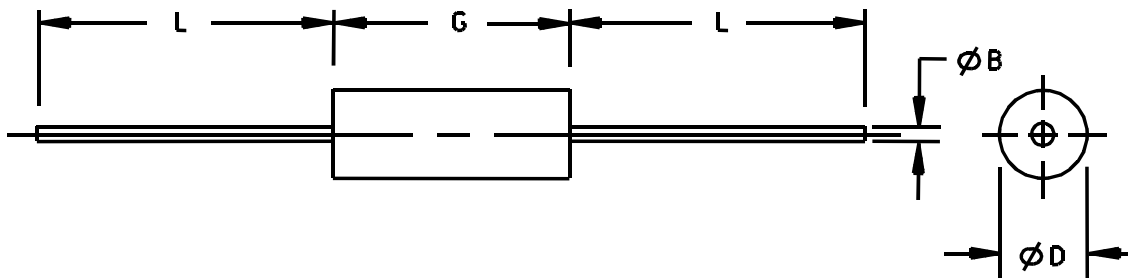
1.3 Maximum ratings.

| Type | V_R | V_{RWM} | I_O (1) $T_A = 55^\circ\text{C}$ (2) | I_{FSM} $I_O = 1.0 \text{ A dc}$ $t_p = 8 \text{ ms}$ |
|-----------------|-------------|---------------|---|---|
| | <u>V dc</u> | <u>V (pk)</u> | <u>A dc</u> | <u>A (pk)</u> |
| 1N4245, EG1 (3) | 200 | 200 | 1.0 | 25 |
| 1N4246, EG1 (3) | 400 | 400 | 1.0 | 25 |
| 1N4247, EG1 (3) | 600 | 600 | 1.0 | 25 |
| 1N4248, EG1 (3) | 800 | 800 | 1.0 | 25 |
| 1N4249, EG1 (3) | 1,000 | 1,000 | 1.0 | 25 |

| Types | Barometric pressure (reduced) | T_{STG} and T_{op} | $R_{\theta JL}$ | $Z_{\theta JX}$ | t_{rr} |
|-----------------|-------------------------------|------------------------|-----------------|-----------------|-----------|
| | <u>mm Hg</u> | <u>°C</u> | <u>°C/W</u> | <u>°C/W</u> | <u>μs</u> |
| 1N4245, EG1 (3) | 8 | -65 to +175 | 42 | 4.5 | 5.0 |
| 1N4246, EG1 (3) | 8 | -65 to +175 | 42 | 4.5 | 5.0 |
| 1N4247, EG1 (3) | 8 | -65 to +175 | 42 | 4.5 | 5.0 |
| 1N4248, EG1 (3) | 33 | -65 to +175 | 42 | 4.5 | 5.0 |
| 1N4249, EG1 (3) | 33 | -65 to +175 | 42 | 4.5 | 5.0 |

- (1) I_O rating is independent of heat sinking, special mounting, or forced air across the body or leads of the device.
- (2) Derate linearly at 8.33 mA/°C between $T_A = +55^\circ\text{C}$ to $+175^\circ\text{C}$.
- (3) See note in 3.8.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

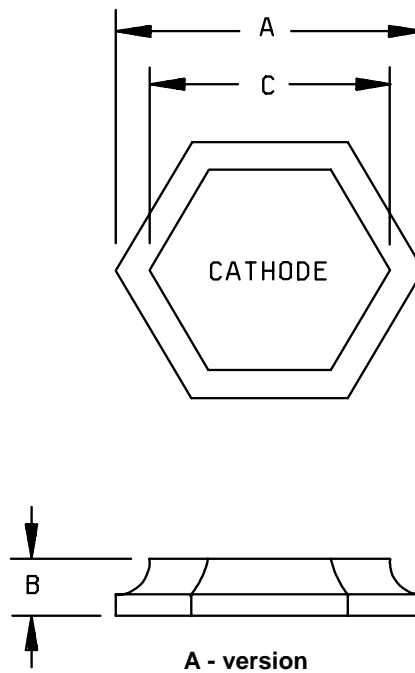


| Ltr | Dimensions | | | | Notes |
|-----|------------|-------|-------------|-------|-------|
| | Inches | | Millimeters | | |
| | Min | Ma | Min | Max | |
| φB | .027 | .033 | 0.69 | 0.84 | |
| φD | .065 | .150 | 1.65 | 3.81 | 3 |
| G | .140 | .250 | 3.56 | 6.35 | |
| L | 1.000 | 1.500 | 25.40 | 38.10 | |

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension φD shall be measured at the largest diameter.
4. The G dimension shall include all uncontrolled areas of the device leads.

FIGURE 1. Physical dimensions.



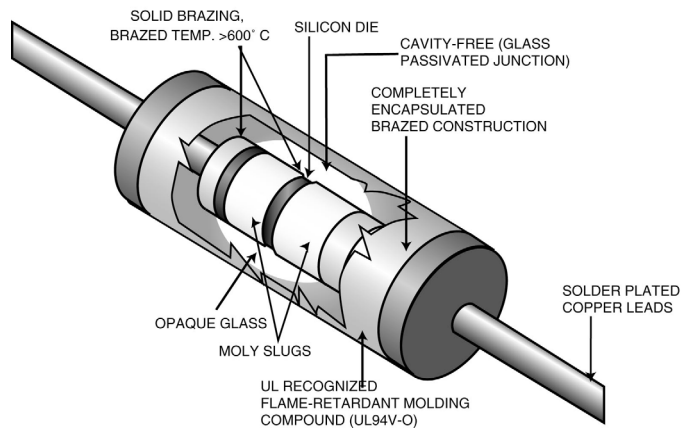
| Ltr | Dimensions | | | |
|-----|------------|------|-------------|------|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .047 | .053 | 1.19 | 1.35 |
| B | .007 | .011 | 0.18 | 0.28 |
| C | .033 | .037 | 0.84 | 0.94 |

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. The physical characteristics of the die are:
 Top metal: Gold 10,000 Å minimum.
 Back metal: Gold 4,000 Å minimum.

FIGURE 2. JANHC (A-version) die dimensions.

Epoxy Glass (EG) Construction



NOTE:

1. See note in 3.8.
2. See figure 1 for dimensions

FIGURE 3. Epoxy-Glass (EG1 case outline) construction (for reference only).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARD

DEPARTMENT OF DEFENSE

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows.

| | | |
|-----------------|---|--|
| EG | - | Epoxy over glass hermetically sealed EG1 case. |
| T _{op} | - | Maximum operating junction temperature. |

3.4 Diode construction. Except for the EG1 version and the JANHC devices, these shall be constructed utilizing metallurgically bonded, thermally matched non-cavity, double-plug construction. The metallurgical bond between the chip and the plug shall meet the category I requirement of MIL-PRF-19500, appendix A.

3.5 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1, figure 2, and figure 3.

3.5.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3.

3.7 Electrical test requirements. The electrical test requirements shall be group A as specified herein.

3.8 Marking. Marking shall be in accordance with MIL-PRF-19500.

NOTE: The EG1 version in this specification is a construction identifier. It denotes a type of design and not a change in package outline. EG1 is not intended to be a new part number or a new package outline identifier. The EG1 version meets all of the requirements of a non-EG1 version including case outline, hermeticity, and electrical parameters. The EG1 may be marked and shipped as a non-EG1 part number because it is an equivalent device in terms of form, fit, and function. The EG1 is interchangeable and substitutable for the non-EG1 version.

3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3).
- c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.3 Screening (JANTX, and JANTXV levels only). Screening shall be in accordance with table IV of MIL-PRF-19500 and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

| Screen (see table IV of MIL-PRF-19500) | Measurement |
|--|--|
| | JANTX and JANTXV levels |
| (1) 3 | See 4.3.3. |
| 9 | Not applicable |
| 11 | I_{R1} and V_{F1} |
| 12 | See 4.3.1 |
| 13 | Subgroup 2 of table I herein. $\Delta V_{F1} \leq +.1, -.2$ V dc; $\Delta I_{R1} \leq 100$ percent of initial values or ± 100 nA dc, whichever is greater. Scope display evaluation (see 4.5.4). |

- (1) Thermal impedance shall be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.
- (2) Thermal impedance is not required in screen 13, if it is already previously performed.

4.3.1 Burn-in conditions. Burn in conditions are as follows: Method 1038 of MIL-STD-750, condition B, $I_0 = 1.0$ amp minimum (in accordance with 1.3 and 4.5.3), $f = 50\text{-}60$ Hz, $V_{RWM} = \text{rated}$ (see 1.3). $T_A = \text{room ambient}$ (see 4.5.2).

4.3.2 JANHC die. Qualification shall be in accordance with appendix H of MIL-PRF-19500.

4.3.3 Thermal impedance $Z_{\theta JX}$ measurements for screening. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum screen limit shall be developed by the supplier using statistical methods and it shall not exceed table I, group A, subgroup 2 herein.

4.3.3.1 Thermal impedance ($Z_{\theta JX}$ measurements) for initial qualification or requalification. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750 (read and record value $Z_{\theta JX}$). $Z_{\theta JX}$ shall be supplied on one lot (500 pieces minimum) and a thermal response curve shall be submitted. Twenty-two of these samples shall be serialized and provided to the qualifying activity for correlation prior to this thermal test. Measurement conditions shall be in accordance with 4.4.1.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I. The following test conditions shall be used for $Z_{\theta JX}$, group A inspection: $Z_{\theta JX} \leq 4.5$ °C/W.

- a. I_M 1 mA to 10 mA.
- b. I_H 5 amps minimum.
- c. t_H 10 ms.
- d. t_{MD} 100 μ s maximum.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIb (JANTX, and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein except for thermal impedance.

4.4.2.1 Group B inspection, table VIb, of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Inspection</u> |
|-----------------|-----------------|--|
| 2 | 4066 | $I_{FSM} = 25$ A (pk), 10 surges of 1/120 s each at 1 minute intervals, superimposed on $I_0 = 1.0$ A dc, $V_R = \text{rated } V_{RWM}$ (see 1.3). |
| 3 | 1027 | $I_0 = 1.0$ A dc minimum; $T_A = +100^\circ\text{C}$ minimum; $T_J = +150^\circ\text{C}$ minimum; $f = 50\text{-}60$ Hz; $V_R = \text{rated } V_{RWM}$ (see 1.3 and 4.5.4). NOTE: I_0 and/or T_A may be increased to achieve a $T_J = +150^\circ\text{C}$ minimum. |
| 5 | 3101 or 4081 | $+25^\circ\text{C} \leq T_R \leq 35^\circ\text{C}$, $R_{\theta JL} \leq 42^\circ\text{C/W}$, $L = 3/8$ inch.(see 1.3 and 4.5.5). |

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein except for thermal impedance.

4.4.3.1 Group C inspection, table VII, of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Inspection</u> |
|-----------------|---------------|--|
| 2 | 2036 | Terminal strength (lead fatigue), test condition E. |
| 5 | 1001 | 5 devices, $c = 0$, pressure = 8 mm Hg for 1N4245, EG1, 1N4246, EG1, 1N4247, EG1; 33 mmHg for 1N4248, EG1, 1N4249, EG1. |
| 6 | 1026 | $I_0 = 1.0$ A dc minimum; $T_A = +100^\circ\text{C}$ minimum; $T_J = +150^\circ\text{C}$ minimum; $f = 50\text{-}60$ Hz; $V_R = \text{rated } V_{RWM}$ (see 1.3 and 4.5.4). NOTE: I_0 and/or T_A may be increased to achieve a $T_J = +150^\circ\text{C}$ minimum. |

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Burn-in and steady-state operation life tests. These tests shall be conducted with a half-sine waveform of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectified current. The forward conduction angle of the rectified current shall be neither greater than 180 degrees, nor less than 150 degrees.

4.5.2 Inspection conditions. Unless otherwise specified, all inspections shall be conducted at $T_A = \text{room ambient}$ as defined in the general requirements of 4.5 of MIL-STD-750.

4.5.3 Burn-in and life tests. These tests shall be conducted with a half-sine waveform of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectified current. The forward conduction angle of the rectified current shall be neither greater than 180 degrees nor less than 150 degrees.

4.5.3.1 Mounting configurations. Any clips or heat sink mounting configurations may be utilized provided that I_0 is adjusted such that the junction temperature of each diode is maintained at $T_J = +135^\circ\text{C}$ minimum for burn-in screening and $T_J = +150^\circ\text{C}$ minimum for JANTX and JANXV life testing.

4.5.4 Scope display evaluation. Scope display evaluation shall be sharp and stable in accordance with method 4023 of MIL-STD-750. Scope display may be performed on ATE (automatic test equipment) for screening only with the approval of the qualifying activity. Scope display in table I, group A, subgroup 4 shall be performed on a scope. Reverse current over the knee shall be 500 μA peak.

4.5.5 Thermal resistance. Thermal resistance shall be measured in accordance with method 3101 or 4081 of MIL-STD-750. The reference point shall be the lead temperature at .375 inch (9.52 mm) from the body of the device (see 1.3).

- a. I_H 2 amps minimum.
- b. I_M 10 mA.
- c. t_H Thermal equilibrium.
- d. t_{MD} 100 μs maximum.

TABLE I. Group A inspection.

| Inspection <u>1</u> / | MIL-STD-750 | | Symbol | Limits | | Unit |
|----------------------------------|-------------|---|-----------------|--------|-----|------------|
| | Method | Conditions | | Min | Max | |
| <u>Subgroup 1</u> | | | | | | |
| Visual and mechanical inspection | 2071 | | | | | |
| <u>Subgroup 2</u> | | | | | | |
| Thermal impedance | 3101 | See 4.3.3. | $Z_{\theta JX}$ | | 4.5 | °C/W |
| Forward voltage | 4011 | $I_F = 3.0$ A (pk), duty cycle ≤ 2 percent pulsed, $t_p \leq 8.3$ ms | V_{F1} | 0.6 | 1.3 | V (pk) |
| Reverse current leakage | 4016 | DC method; $V_R =$ rated (see 1.3) | I_{R1} | | 1.0 | μ A dc |
| Breakdown voltage | 4021 | $I_R = 100$ μ A dc | $V_{(BR)}$ | | | |
| 1N4245, EG1 | | | | 240 | | V |
| 1N4246, EG1 | | | | 480 | | V |
| 1N4247, EG1 | | | | 720 | | V |
| 1N4248, EG1 | | | | 960 | | V |
| 1N4249, EG1 | | | | 1,150 | | V |
| <u>Subgroup 3</u> | | | | | | |
| High temperature operation: | | $T_A = +150^\circ\text{C}$ | | | | |
| Reverse current leakage | 4016 | DC method, $V_R =$ rated (see 1.3) | I_{R2} | | 150 | μ A dc |
| Low temperature operation: | | $T_A = -65^\circ\text{C}$ | | | | |
| Forward voltage | 4011 | $I_F = 3.0$ A (pk), duty cycle ≤ 2 percent pulsed, $t_p \leq 8.3$ ms | V_{F2} | | 1.5 | V dc |
| <u>Subgroup 4</u> | | | | | | |
| Reverse recovery time | 4031 | Condition B, $I_F = 0.5$ A, $I_R = 1.0$ A, $I_{(REC)} = 0.25$ A | t_{rr} | | 5 | μ s |
| Scope Display | 4023 | Sharp and stable $n = 116$; $c = 0$ | | | | |

1/ For sampling plan, see MIL-PRF-19500.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).
- c. Lead finish (see 3.5.1).
- d. Type designation and product assurance level.
- e. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers' List (QML) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN). This information in no way implies that manufacturer's PINs are suitable as a substitute for the military PIN.

6.5 Suppliers of die (if applicable).

| JANC ordering information | |
|---------------------------|--------------|
| PIN | Manufacturer |
| | 14552 |
| 1N4245, EG1 | JANHCA4245 |
| 1N4246, EG1 | JANHCA4246 |
| 1N4247, EG1 | JANHCA4247 |
| 1N4248, EG1 | JANHCA4248 |
| 1N4249, EG1 | JANHCA4249 |

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Army - CR
Navy - EC
Air Force - 11
DLA-CC

Preparing activity:

DLA - CC

(Project 5961-2626)

Review activities:

Army - AR, MI
Navy - AS, MC
Air Force - 19, 99

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**INSTRUCTIONS**

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-19500/286F

2. DOCUMENT DATE
3 October 2002

3. DOCUMENT TITLE

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER, MEDIUM-RECOVERY TYPES 1N4245 THROUGH 1N4249, 1N4245EG1 THROUGH 1N4249EG1, JAN, JANTX, JANTXV, AND JANHC

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION**6. SUBMITTER**

a. NAME (Last, First, Middle initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)
COMMERCIAL
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7. DATE SUBMITTED

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